Idaho State University

Focusing and Bending Magnet Construction

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ISU is commissioning an off-axis bremsstrahlung beam facility, which produces a linearly polarized photon beam in the energy range of 1 to 15 MeV with a polarization of 30%. A new technique for detecting actinides is being investigated, which takes advantage of the unique angular signature of neutrons resulting from photofission through linearly polarized photons. In other words, a technique is being developed to use linear accelerators to detect nuclear material bad guys might try to sneak into the country to do us harm. The high school students helped in this work by continuing construction and testing of focusing and bending magnets for the electron beam line begun by QuarkNet students last summer. They used a lathe to wind the magnets, and machine tools to construct frames and housing. They used a Hall effect probe to map out the magnetic field of all four of the magnets they constructed. They compared these to the four constructed by QuarkNet students last summer to ensure consistency.

Radiation Biology

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The ISU radiation biology lab focuses on radiation effects in microbes, particularly the survival mechanisms employed by a wide variety of species. The model organisms we use come from all three kingdoms of life: bacterial *(E. coli, Bacillus* sp., *Deinococcus radiodurans*), archael (*Halobacterium* sp.) and eukaryotic (*Schizosaccharomyces pombe* and *Dictyostelium discoideum*.) Through a series of irradiation/growth cycles, we have selected for “super-resistant” strains of *Halobacterium*. Microarray analysis has shown that these strains are unregulated for a particular gene involved in basic DNA metabolism (replication, repair and recombination). QuarkNet students worked on further characterization of these strains through DNA sequencing analysis, cloning of mutant genes and moving the resistance gene from one strain to another. The high school students also helped isolate strains of *E. coli* with enhanced survival with regards to temperature and salinity extremes. Unlike the halobacterial strains, the *E. coli* strains started out deficient for a major DNA repair enzyme. This project involved identifying the gene(s) that are altered in the mutant strains, and attempting similar manipulations to the *Halobacterium system*. This work could eventually lead to better treatment methodologies for cancer therapy by discovering ways to enhance repair and resistance mechanisms in healthy tissue.